Subsurface Investigation of Petroleum Contamination at Thompson's Garage

Woodstock, Vermont

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Prepared for:

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1.0 INTRODUCTION

The Johnson Company, Inc., has completed a subsurface investigation of petroleum contamination at Thompson's Garage, Inc., in Woodstock, Vermont. Thompson's Garage is an auto maintenance and repair station and gasoline filling station on Vermont Route 12, in the Town of Woodstock, Vermont, at the junction of Rte. 12 and the North Pomfret Road (see Figure 1). The garage has existed at this location for many years.

This site assessment is being performed under the direction of the Vermont Department of Environmental Conservation (DEC). The DEC received a complaint in October 1991 that water from a nearby supply well used by Eaton (see Attachment 1) had a gasoline taste. Subsequent sampling of this well and others nearby has indicated that the Eaton well contained detectible quantities of petroleum related compounds, but that other nearby wells did not.

On November 21, 1991, the Vermont DEC wrote to Mr. Thompson and requested that a site assessment be performed in the vicinity of Thompson's garage, to estimate the nature (composition, dissolved or separate phase), concentration, aerial extent, direction and the approximate rate of movement of contaminated groundwater in the immediate area, and to determine whether the contamination was derived from the buried fuel storage tanks at Thompson's Garage. In addition to the nearby domestic drinking water supplies, there are also 2 municipal water supply wells (1 in use, 1 proposed for use) approximately 1,500 feet north of Thompson's Garage (see Figure 1). These supply wells are owned and operated by the Woodstock Aquaduct Company.

Thompson's Garage currently uses 3 subsurface gasoline tanks. These consist of a 6,000 gallon unleaded tank and two 4,000 gallon tanks, one for super unleaded gasoline and the other for plus-grade gasoline. Each of these tanks and their associated plumbing were leak tested on November 12-13, 1991, by Test Engineering Company, Inc., of Brookfield, Vermont. Each of these tanks was certified tight by Test Engineering Company, Inc.

This report summarizes the procedures used and the results of the investigation that was performed at Thompson's Garage by The Johnson Company, Inc., and its subcontractors. The results of the site investigation will be used to decide whether additional investigative and/or remediative measures should be implemented in order to protect nearby water supply wells and water resources.

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FIGURE 1 – SITE LOCATION MAP
THOMPSON'S GARAGE
WOODSTOCK, VERMONT

THE JOHNSON COMPANY, INC.
Environmental Sciences and Engineering
MONTPELIER, VERMONT

2.0 SUMMARY OF WORK PERFORMED

The scope of work performed by The Johnson Company and its subcontractors during this investigation consisted of the following elements:

A. Review of previously existing literature.

B. Soil Borings and Groundwater Monitoring Well Installation.

C. Water level measurements.

D. Sampling and analysis of monitoring wells for petroleum-related compounds.

E. Site Survey.

During this investigation, The Johnson Company worked with 3 subcontractors to accomplish the drilling and well installation, site survey, and analysis of water samples. A site specific health and safety plan was prepared and used during the fieldwork portions of this investigation. We contacted Dig-safe and obtained authorization #91521790, with legal drilling occurring after 10 AM on Tuesday, December 31, 1991.

These tasks, and the results obtained therein, are further described below.

3.0 DISCUSSION OF PROCEDURES AND RESULTS

During our site investigation, we evaluated available information and literature relating to the geology and hydrogeology of the site, including information obtained from the following sources:

A. Files of the Petroleum Sites Section, Hazardous Materials Management Division, Vermont Department of Environmental Conservation (DEC);

B. Files of the Water Supply Division of the DEC;

C. Files of the Woodstock Aquaduct Company, with respect to information on the existing water supply wells;

D. Information obtained via telephone conversation with the Vermont Department of Health;

E. Literature relative to the surficial geological history of the Woodstock area, which is further referenced at the end of this report.

The existing information consists of numerous drilled well logs, test well logs and pumping summaries, water quality data, and papers and articles relating to the geological history of the Woodstock area. An understanding of the geological history of the area is useful in better evaluating the specific conditions at Thompson's Garage.

4.0 GLACIAL GEOLOGICAL HISTORY

The geology of the Woodstock area is, like the rest of the State of Vermont, a product of glacial erosion of a fractured bedrock surface and concurrent and subsequent glacial deposition on that bedrock surface. There is some long-standing disagreement in the literature relative to the number of glacial advances in this area, and their duration.

According to Stewart and MacClintock (1969), the Woodstock area has been overrun by ice sheets at least twice in the past 20,000 years. They cite as evidence the presence of unweathered glacial till over a weathered glacial till in roadcuts in the Kendron Brook area of South Woodstock, and also about 4 miles northwest of Woodstock along Route 12. They also reference exposures of older Bennington Till in the Norwich area which contain significant weathered zones, as evidence of a warm weather period of significant duration, prior to the deposition of younger Shelburne till in the area.

The concept of multiple ice advances in the Woodstock area is disputed by Larsen (1987). He believes that the evidence supporting the multiple advance theory is untenable, and that only 1 ice sheet advanced and melted back during the past 20,000 years.

There is general agreement that glacial Lake Hitchcock existed in the Connecticut River Valley area following the last glacial melt. Stewart and MacClintock (1969) report numerous exposures of lake bottom sediments in the valley of the Ottauquechee River, at various elevations as high as 1,100 feet above mean sea level. In the Hanover area, Lake Hitchcock sediments are mapped at elevation 700 feet, and in the Kendron Brook area, at 800 feet. Upstream of Quechee gorge, approximately 1 mile west of the village of Quechee, exposures of lacusterine gravels overlie laminated silts and sands; the elevation of the top of these exposures is about 700 feet. These deposits extend about 2 miles southeast of the gorge toward Taftsville, where the valley widens to about 1.5 miles, and are mapped throughout the valley at that location.

It seems likely that the sediments at Thompson's garage are the product of a fluctuating glacial lake environment. The relatively flat ground surface in the Broad Brook valley is at an approximate elevation of 700 feet. According to the literature referenced above, the elevation of glacial Lake Hitchcock fluctuated between elevations of at least 700 feet and 1,100 feet, although it could be possible that other alpine lakes created the higher elevation deposits. Thus, it seems likely that any widespread glacial lake in the Connecticut Valley would have submerged the valley now occupied by Broad Brook.

The sediments reported from well logs in the Broad Brook and Gulf Stream valleys are consistent with a fluctuating glacial lake theory. Specifically, the stratigraphy in the valleys is predominantly composed of a shallow (5-30 feet thick) layer of sandy materials at the ground surface, underlain by a 15-35 foot thick silty clay layer, which is in turn underlain by a 20-30 foot thick sand and gravel layer. The thickness of each of these layers varies at different locations, but each is generally uniformly present, except where bedrock is close to the ground surface. The silty clay layer is likely the product of a relatively quiet lake environment, where the coarser sediments have been deposited closer to the lakeshore, leaving only the finer particles to gently settle toward the deeper parts of the lake. The clay content of this layer seems to decrease toward the south, and at the TW-5 location of the Woodstock Aquaduct Company, little or no clay is reported in a sandy silt layer that otherwise correlates with the silty clay from the rest of the valley. This may indicate an increase in the velocity of water movement toward the constricted southern end of the Broad Brook valley, during the glacial lake stage.

The sandy layers over and under the silty clay layer may represent periods of lowered lake levels, where the valley was much closer to the lake shore. In this case, the sands and gravels may represent shallow water or wave-washed deposits from the lake. An alternate hypothesis is that the sands and gravels represent the meltwater stream or deltaic deposits of glaciers prior to or during their entry into the lake (Stewart and MacClintock, 1969).

5.0 SOIL BORINGS AND GROUNDWATER MONITORING WELL INSTALLATION

During our investigation, the Johnson Company oversaw the installation of 5 groundwater monitoring wells on and near Thompson's Garage. All wells were installed under the supervision of Carl Hanson, a Johnson Company geologist. The as-built location of the groundwater monitoring wells is shown on Attachment 1. The wells were installed by Tri-State Drilling and Boring, Inc., of West Burke, Vermont. All monitoring wells were installed in accord with Standard Operating Procedure JCO-003. A truck-mounted hollow-stem auger drilling rig was used to drill the boreholes and install the monitoring wells. All equipment was steam-cleaned before the start of the first borehole, between each borehole, and after the last borehole is completed.

Split-spoon soil samples were taken at regular 5 foot intervals during drilling. Each sample was field analyzed using a photoionization detector to detect any presence of volatile organic compounds in the samples. The results of the photoionization screening are included on the well logs in Attachment 2. All monitoring wells were constructed of 2 inch diameter PVC well pipe, with 10-foot screens. All drill cuttings and well purge water were of disposed on-site during the assessment.

Monitoring wells MW-1, -2, -4, and -5 are completed above ground and are protected with cylindrical steel casings and padlocks. MW-3 was completed below the ground surface with a curb box and a compression fitting.

The detailed boring logs are included in Attachment 2. The soil boring logs indicate that all five of the new monitoring wells are completed in the upper sandy aquifer, and that none of the wells reaches or penetrates the silty clay layer, which is presumed to exist beneath the site. The sediments encountered during the soil borings are generally fine to coarse sands, with some gravelly layers and some silt dispersed throughout. A silty sand layer was encountered at 20-22 feet in MW-1. Water was generally encountered between 10-15 feet below the ground surface in these borings.

These new monitoring wells were in addition to 4 existing monitoring wells which surround the three buried gasoline storage tanks. The previously-existing monitoring wells are finished about 10 feet below the ground surface and did not have any groundwater in them during the duration of our investigation.

5.1 MONITORING WELL LOCATIONS

The objectives of groundwater monitoring well installation included prediction of groundwater flow direction, establishment of water quality monitoring points, prediction of contaminant migration direction, and delineation of a source of contaminants if possible. The justification for and location of each well are as follows.

A. MW-1-This well was installed northwest of the garage, and it serves as an upgradient monitoring well between the buried gasoline storage tanks and the existing municipal water supply, for water level and water quality sampling purposes.

B. MW-2-This well was installed northeast of the garage, in the immediate vicinity of the Thompson's existing drilled well. This well is also upgradient of the buried gasoline storage tanks, and is between the buried fuel tanks and the proposed municipal water supply.

C. MW-3-This well is southeast of the buried fuel storage tanks, between the tanks and the North Pomfret road. This well allows water level measurements and chemical quality sampling in the immediate vicinity of the fuel tanks, and provides a monitoring point upgradient of the Eaton's well.

D. MW-4-This well is located immediately south of the buried fuel tanks, and provides information as to movement of contaminants in a southerly direction.

E. MW-5-this downgradient well is the only off-site monitoring well installed, and is in the

front yard of the Eaton residence. This well location provides an additional downgradient water level and quality point, and is intermediate to the Eaton well point and MW-3.

5.2 GROUNDWATER LEVELS

Groundwater level measurements were taken on three occasions during our investigation: on January 7, 1992, the time of installation of the monitoring wells, on January 16, 1992, during the sampling of the monitoring wells, and on January 31, 1992. The results of these water level measurements are summarized in Table 1. It should be noted that all measurements identified as "Thompson's" were taken from a well point located in the basement of the garage, which is no longer in use as a water supply. The Thompson's currently rely upon a drilled well to the northeast of the garage for their water supply, which has a buried casing and is currently inaccessible for water level measurements.

The water level measurements taken on January 7 included the 5 newly-installed monitoring wells, and the Eaton's and Thompson's wells. These water level measurements were taken late in the day, after sunset, and the field geologist reports some uncertainty as to the water levels in MW-2, -3, and -5. Also, the drilling and development of these wells on the same day introduce an additional degree of uncertainty as to the equilibration of the water levels.

The water level measurements taken on January 16 included the 5 groundwater monitoring wells. We had intended to also measure the Thompson's and Eaton's wells on this date, however, the extremely cold temperatures resulted in a freezing malfunction of the water level probe, and we were unable to complete the measurements on that date.

On January 31, water level measurements were taken from the 5 groundwater monitoring wells, and the Eaton's, Maynes, and Thompson's wells. These measurements were obtained with a high degree of confidence in the results. On this date, the curb box for MW-3 was filled with ice, and water had also seeped into the PVC well casing and froze, plugging the well. This situation was remedied with a crowbar and hot water, some of which flowed into the well. Several hours elapsed before the water level was measured, and given the relatively high hydraulic conductivity of the aquifer materials, that the water level as measured was likely at equilibrium. Also on this date, the jagged top of the PVC well casing of MW-3 was smoothed to allow a better compression fit, to avoid additional seepage of water into the well. This resulted in a 1/8 inch reduction in the elevation of the water level measurement point (top of PVC casing) for this well. Since this was performed after the well elevation was surveyed, water level measurements taken on January 31 have been appropriately adjusted to account for the lowering of the top of the casing.

TABLE 1

Water Level Measurement Summary
Thompson's Garage

Location	Elevation: Top of Casing	Elevation: Ground Surface	Water Level Measurement (Elevation)		
			1/7/92	1/16/92	1/31/92
MW-1	699.78	697.69	12.5 (687.28)	14.65 (685.13)	14.81 (684.97)
MW-2	698.27	696.05	10.9 (687.37)	13.08 (685.19)	13.32 (684.95)
MW-3	697.29[1] (697.17)	697.55	12.1 (685.17)	12.96 (684.33)	12.30 (684.87)
MW-4	700.23	698.06	12.9 (687.33)	15.08 (685.15)	15.27 (684.96)
MW-5	698.79	698.32	13.3 (685.49)	13.68 (685.11)	13.86 (684.93)
Eaton	693.01	—	8.63 (684.38)	— NR	8.10 (684.91)
Maynes	696.03	695.03	— NR	— NR	11.78 (684.25)
Thompson's Point	692.66	—	7.58 (685.08)	— NR	7.65 (685.01)

Note: All elevations expressed in feet above mean sea level. Elevation survey performed by Bruno Associates 1/30/92
NR = Not recorded

The water table contours presented on the Site Plan, Attachment 1, are based upon the water level measurements taken on January 31, 1992. The water level measurements taken on January 16 produce a similar water table configuration to the January 31 results.

The water level information from January 31 was plotted using a mathematical interpolation technique, which assumes a constant slope of the water table between measurement points. Only measurement points open to the uppermost aquifer were included in this plot; the Mayne's water supply was not included in the creation of the water table contours, as it is screened in the lower aquifer.

When the actual water level elevations are plotted, it is apparent that the water table of the uppermost aquifer is quite flat, with a range of elevation from 685.01 feet in the Thompson's well, to

[1] On 1/31/92, approximately 1/8 inch was removed from the top of the PVC casing for MW-3 in order to create a smooth lip to allow a thorough seal with the compression fitting.

684.87 feet in MW-3. The contour interval of the equipotential lines created from the January 31 data was 0.05 feet. The water table slope on January 31 ranges from 0.0325 ft/ft (3.25%) in the vicinity of a line between MW-3 and MW-4, downward to 0.000625 ft/ft (0.06%) in the vicinity of a line between MW-1 and MW-3.

The apparent configuration of the water table on January 31 was of a general slope toward the southeast, with a slight trough and ridge both trending about north 20° west, and positioned beneath the gasoline tanks and the paved area, respectively. Assuming that groundwater flow in the uppermost aquifer is normal to the equipotential lines depicted on Attachment 1, then the predicted direction of groundwater flow in the uppermost aquifer beneath the garage is in a southeasterly direction, towards the Eaton residence, with local variations induced by the previously-referenced trough and ridge.

The range of velocities of groundwater flow in the uppermost aquifer can be roughly estimated using Darcy's law, which can be manipulated to the following form to calculate saturated groundwater flow velocities:

$$v = \frac{k \cdot i}{n}$$

where

v = saturated velocity of groundwater flow
k = hydraulic conductivity of saturated sediments
i = hydraulic gradient = dh/dx
n = porosity of saturated sediments

Field description of the saturated sediments in MW's -3, -4 and -5 by both Johnson Company and Tri-State personnel indicate that the predominant sediment type is a fine to coarse sandy gravel with some silt dispersed throughout. The variation in particle size and the presence of some dispersed silt will lower the assumed permeability of the sediments. Fetter (1980, pg. 75) gives a range of hydraulic conductivities for silty sands of this nature of 10^{-5} cm/sec to 10^{-3} cm/sec, and 10^{-3} cm/sec to 10^{-1} cm/sec for well-sorted sands and glacial outwash. Freeze and Cherry (1979, pg. 29) provides a range of hydraulic conductivity values for silty sands from 10^{-5} cm/sec to 10^{-1} cm\sec. Without site-specific hydraulic conductivity data, an order-of-magnitude estimate of hydraulic conductivity of the saturated sediments can be produced, and a range of groundwater flow velocities of similar accuracy can be calculated. Using visual descriptive logs of the sediments beneath the site as obtained from the soil borings, the probable range of hydraulic

conductivity of the saturated surficial aquifer is from 10^{-3} cm/sec (28.35 feet/day) to 10^{-2} cm/sec (283.5 feet/day).

Porosity of saturated materials beneath the site has not been measured, however Fetter (1980, pg. 64) provides a range of porosity of from 20% to 35% for mixed sand and gravel. Freeze and Cherry (1979, pg. 37) provides a range of porosity for sand from 25-50%. Since the on-site sediments are somewhat well graded (poorly sorted) with respect to particle size distribution, the smaller grains probably fill void spaces between the larger grains, resulting in a net reduction in porosity. Thus, the actual porosity may be toward the lower end of these ranges.

A potential range of groundwater flow velocities beneath Thompson's Garage is defined by calculation, using the high and low potential values of gradient, hydraulic conductivity and porosity of the sediments.

$$V_{max} = \frac{(283.5 feet/day)(0.0325 feet/foot)}{0.25} = 36.9 ft/d$$

$$V_{min} = \frac{(28.35 feet/day)(0.000625 feet/foot)}{0.35} = 0.05 ft/d$$

It should be noted that the higher gradient referenced above was restricted to a small portion of the site on January 31, while the lower gradient was more widespread. Actual velocities of groundwater flow are likely dependent upon the micropermeability of the sandy gravel layers. Also, given the very flat water table configuration and the shallow depth to groundwater, it is quite possible that the water levels, water table configuration and local gradients fluctuate enough in response to precipitation and snowmelt to induce periodic changes in the velocities and directions of groundwater flow beneath the site.

5.3 GROUNDWATER SAMPLES

During the investigation, The Johnson Company collected water samples from each of the 5 newly-installed monitoring wells. The sampling was performed according to SOP-JCO-008, Standard Operating Procedure for Groundwater Sampling of Monitoring Wells: Water Quality. One trip blank was also collected for quality control and assurance purposes, to ascertain that any contamination found in the

samples was not introduced by anomalous means. These samples were collected with dedicated disposable bailers on January 16, 1992.

All water quality samples were placed in 40 mil vials and delivered under chain-of-custody arrangements to SciTest Laboratories in Randolph, Vermont on the day of collection. The samples were analyzed on January 22 and 23, 1992 using EPA Method 8020 for petroleum-related compounds. The sampling results were verbally transmitted to the Johnson Company on January 31, 1992, with a written report received on February 5, 1992.

The analytical results are summarized in Table 2. Copies of the laboratory report are included in Attachment 3. None of the compounds listed on the laboratory report were detected during the analysis in the trip blank or in the samples from MW-1 and MW-2.

Positive detections of one or more of the listed compounds were made on the samples of water from MW-3, -4, and -5. Of these wells, MW-3 was found to contain the highest concentrations of benzene, toluene, ethylbenzene, total xylenes and methyl tertiary butyl ether (MTBE).

The concentrations of benzene, toluene, and ethylbenzene were about 2 orders of magnitude lower in MW-4 than in MW-3; total xylenes were present in MW-4 at about half of the concentration detected in MW-3. MTBE was not detected above 10 ppb in MW-4.

Benzene and MTBE were detected in MW-5, at two orders and one order of magnitude lower, respectively, than in MW-3. Toluene, ethylbenzene and total xylenes were not detected in MW-5.

The locations of MW-1 and MW-2 northwest and northeast, respectively, of the buried fuel storage tanks are apparently upgradient with respect to the flow of groundwater. The absence of detectible concentrations of the listed compounds in either of these wells on January 16, 1992, supports the notion of the upgradient location of both of these wells.

Monitoring well MW-3 is apparently downgradient of the buried fuel storage tanks with respect to the flow of groundwater, and the concentrations of volatile organic compounds in this well relative to the other monitoring wells suggest that it is closest to the source of the contaminants. Contaminant transport in the vicinity of this well may be due to advective transport, diffusion, dispersion or a combination of these mechanisms.

TABLE 2

Water Quality Summary
Thompson's Garage

Compound	Thompson's Garage	MW-1	MW-2	MW-3	MW-4	MW-5	Eaton Source (in)
		Sample taken on 1/16/92					
Benzene	ND - 11/6/91	ND	ND	2,510	46	23	375 10/31/91 380 10/31/91 250 11/21/91 320 12/02/91
Toluene	ND - 11/6/91	ND	ND	10,300	614	ND	710 10/31/91 770 10/31/91 280 11/21/91 145 12/02/91
Ethylbenzene	ND - 11/6/91	ND	ND	670	12	ND	20 10/31/91 20 10/31/91 ND 11/21/91 ND 12/02/91
Total Xylenes	ND - 11/6/91	ND	ND	8,860	4,290	ND	820 10/31/91 875 10/31/91 420 11/21/91 325 12/02/91
MTBE	ND - 11/6/91	ND	ND	168	<10	26	ND 10/31/91 ND 10/31/91 ND 11/21/91 ND 12/02/91
Total Volatile Hydrocarbons	ND - 11/6/91	NR	NR	NR	NR	NR	6,690 10/31/91 7,280 10/31/91 2,850 11/21/91 2,380 12/02/91

Only positive Water Quality Results Included; Compounds not listed were not detected. All results in ug/l (parts per billion)
ND = Not Detected
NR - Not Reported
1,2-, 1,3-, and 1,4-, dichlorobenzene reported at less than 10 ppb in MW-(1/16/92); no other reported detections within the parameters of this summary

NOTE: Other water supplies sampled by DEC on 11/6/91 included current water supplies of Thompson's Garage, Woods, Maynes, Teagle and the school. No volatile organic compounds were detected in these supplies on that date. Also, the Eaton's water system "mid" and "out" locations were tested on 11/21/91 and 12/2/91; no VOCs were detected.

Monitoring well MW-4 is apparently slightly up- or cross-gradient of the buried fuel storage tanks as of January 31, 1992. The relative lower concentrations of contaminants detected in this well suggest that it is further removed from the source of contaminants than is MW-3. Contaminants in this well may have travelled via diffusion; alternatively, slight water level fluctuations beneath the site could allow advective transport to occur in that direction.

Monitoring well MW-5 is apparently cross-gradient relative to the buried fuel storage tanks as of January 31, 1992. The location of this monitoring well is such that contaminants could travel to it by diffusion from a migrating plume to the north of the well; alternatively, slight water level fluctuations could allow advective transport to occur. The relatively low concentrations of contaminants in this well suggest that it lies on the fringe of a migrating plume of dissolved contaminants.

The DEC has collected water samples from nearby drinking water supplies on at least 3 occasions since October 1991. The results of these sample analyses are also included in Table 2. None of the tested supplies, with the exception of the Eaton's supply, were found to contain detectible concentrations of volatile organic compounds during EPA Method 8240 analysis.

The Eaton supply has been tested at least 3 times since November 1991. A duplicate sample was obtained from this supply on October 31, 1991. The results of these analyses indicate that benzene, toluene, ethylbenzene and total xylenes have been detected in this supply well. The general trend of concentration over time has been downward in this well, with few exceptions. Benzene and total xylene concentrations have declined to less than half of their originally-detected concentrations as of December 2, 1991, while benzene has declined slightly and has fluctuated. Ethylbenzene has declined from 20 ppb in October samples to less than 2 ppb in November and December sampling. MTBE has not been detected in the Eaton's supply as of December 2, 1991.

The compounds and concentrations detected in the Eaton's well are most similar to those found in MW-4, especially with respect to toluene and ethylbenzene concentrations, and with respect to the absence of MTBE in both wells. The concentrations of compounds detected in the Eaton's well are less similar to MW-3 and MW-5; contaminant concentrations in Eaton's well are higher than in MW-5 but lower than in MW-3; MTBE is found in both MW-3 and MW-5.

In the absence of free product composition data, fingerprinting of the contaminant concentrations to determine the type or age of the dissolved contaminants is speculative. The presence of MTBE in MW-

3 and MW-5, and its absence above detectible levels in MW-4 and the Eaton's well, raises the possibility of two different sources of contamination. One possible explanation for this observation is that the source of the contaminants existed prior to and following the introduction of MTBE into the fuel; another potential explanation is that two separate sources, one containing MTBE, the other free of MTBE, are present. MTBE is very mobile, and its presence usually is in advance of other, less-mobile constituents. It is somewhat unusual to find benzene, toluene, ethylbenzene and xylene, all large aromatic organic molecules, without MTBE, if the source of the contaminants contained MTBE. It is possible that MTBE was present in MW-4 on January 16, 1992, at concentrations lower than 10 ppb.

6.0 SITE SURVEY

A site elevation and position survey was performed at Thompson's garage on January 30, 1992. The field survey work was performed by Bruno Associates, of Woodstock, Vermont. They surveyed the elevation and position of monitoring wells and other relevant features in the area to establish a basis for prediction of groundwater flow direction and velocities.

The field data was transferred electronically with hard copy backup to the Johnson Company's CADD system for site plan preparation. The finalized site plan is included as Attachment 1.

6.1 NEARBY WATER SUPPLY WELLS

There are several water supply wells within a 500 foot radius of Thompson's garage, and which are currently in use. Individual domestic supply wells in the immediate area include the Thompson's drilled well; the Eaton's dug well; the Mayne's drilled well; and water supplies at the Woods and Teagle residences. Other nearby residences to the south are served by the Woodstock Aquaduct Company municipal water supply system.

The Woodstock Aquaduct Company draws water for its municipal water system from a gravel well in the Gulf Stream Valley, approximately 1,800 feet northwest of Thompson's Garage (Figure 1), and about 100 feet west of Vermont Route 12. According to well test records, this well yields about 400 gallons per minute at 29.5 feet of drawdown. Additionally, The Woodstock Aquaduct Company has investigated the development of a second municipal well approximately 1,400 feet north of Thompson's garage, near the intersection of the North Pomfret Road and the crossroad to the north of Thompson's garage (Figure 1).

The well log for the existing municipal supply well indicates that it penetrates about 8 feet of

topsoil, and 30 feet of grey clay before passing into 23 feet of sand and gravel, in which the well is screened. A three-foot thick layer of silt was encountered over bedrock, which was reached at 64 feet below the ground surface. Thompson's Garage is outside of the primary Wellhead Protection Area (WHPA) for the existing municipal water supply well, but is within the secondary WHPA for this well.

The well log for the proposed municipal supply well (TW-4) indicates that it penetrates about 27 feet of sand and gravel, 11 feet of silty fine sand and 19 feet of gray silty clay before passing into 14 feet of silty gravel in which the well is screened. Bedrock was encountered at 71 feet below the ground surface. We have no knowledge of any wellhead protection area or classified groundwater designation associated with TW-4 as of the time of preparation of this report.

Aquifer test data and calculations produced during the location and construction of the existing municipal water supply well in 1970 and 1971 indicates that the aquifer in which the well is screened is narrow and confined, with a limited zone of influence and numerous hydraulic boundaries (Layne New England, 1970). A test well at this location was pumped at a rate of 400 gallons per minute for 60 hours in 1970; the computed permeability of the aquifer was 16,000 gallons per day per foot, and the transmissivity was about 37, 500 gallons per day per foot squared. Water level measurements taken during the test indicate that the static level in the well before the test began was 5 feet below the ground surface, and that after pumping at 400 gallons per minute, about 29 feet of drawdown had occurred. Water level measurements taken in observation wells at distances of 2, 50, and 150 feet from the pumping well indicated progressively less drawdown with distance from the pumped well; a maximum drawdown of 3 feet was observed at the 150 foot distance, 7,000 minutes (4.9 days) following the commencement of pumping. It should be noted that these observation wells were in a line extending westward from the pumped well, and that the cone of depression for this well may have been asymmetric.

The technical report for this aquifer test states that the likely recharge source for the well is the Gulf Stream and possibly Broad Brook (Layne New England, 1970). The deposit in which the well is screened appeared to be narrow and confined, extending north and south along the Gulf stream valley, and likely intersecting the stream at numerous points. According to this report, the likely recharge to this deposit is upstream of the well, although some downstream contribution could not be ruled out.

It appears unlikely that the contaminants detected in the vicinity of Thompson's Garage pose a significant threat to the quality of either the existing or the proposed municipal water supply wells. The contamination at the garage has to date only been found in the uppermost sandy aquifer, which appears to

flow toward the southeast, toward Broad Brook, and away from the supply well locations. It should be noted that our scope of work did not include a systematic investigation of the lower gravel aquifer in the vicinity of Thompson's garage for flow direction or water quality.

No petroleum-related contamination was detected in either MW-1 or MW-2 at Thompson's garage on January 16, 1992. This indicates that despite the very low gradient measured beneath the site, contaminants have not been transported to either of the upgradient wells, either by advective flow or diffusion against the shallow gradient.

Both of the municipal supply wells are screened in the lower gravel aquifer, which is separated from the upper sandy aquifer by a 19-30+ foot thick silty clay layer. Qualitatively, it appears that this silty clay layer would provide a high degree of protection for the municipal water supplies. Calculations prepared by Wagner, Heindel and Noyes for the Woodstock Aquaduct Company (1991) indicate that in the vicinity of the proposed municipal supply well, the calculated travel time through the silty clay layer for water is about 15.8 years, based upon a hydraulic conductivity of 3.3×10^{-3} feet per day, a downward hydraulic gradient of 1.0, a porosity of 0.4 and a clay thickness of 19 feet.

The drilled well log for the Mayne's Water supply indicates that the clay layer is about 20 feet thick at this location. Under the same assumptions described above, a similar travel time would be obtained (16.6 years). However, water level measurements taken from the Mayne's well and the Thompson's monitoring wells indicate that the actual hydraulic gradient between the upper and lower aquifers is much less than 1.0. Under the present conditions of pumping of nearby domestic water supplies, the water level in the Mayne's well is approximately 0.7 feet lower than the highest water level measured at Thompson's garage in any of the wells. Assuming that the difference in hydraulic head measured for the upper and lower aquifers is reflected within the silty clay layer at the Mayne's residence, and assuming an elevation difference of 56' between the center of the screened interval of the monitoring wells and the bottom of Mayne's well, a vertical hydraulic gradient of 0.0125 feet per foot is calculated (Attachment 4), and this in turn produces a travel time through the clay layer of about 531 years. The water quality testing performed by the DEC on the Thompson's and Mayne's water supply wells, which are screened in the lower gravel aquifer, has not to date detected any petroleum-related compounds. In short, the nearly-identical water levels obtained from the lower and upper aquifers will serve to further retard the potential migration of contaminants from the upper to the lower aquifer.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The investigation performed by The Johnson Company at Thompson's Garage has demonstrated that some petroleum-related contamination of the shallow groundwater aquifer exists beneath and southeast of the Thompson's Garage property. The contamination that has been detected to date consists entirely of dissolved phase constituents. No free product has been observed in any of the monitoring wells during the installation, sampling and water level measurement work performed to date at the garage.

Groundwater flow in the uppermost aquifer beneath the site is generally toward the southeast. A slight groundwater trough and companion ridge cut the site from southeast to northwest, based upon the January 31, 1992 water level measurements. The water table slope is very flat, generally less than 1%, with local variation. The average velocity of groundwater flow beneath the site is probably less than 1 foot per day.

The types of compounds detected in water samples collected from the groundwater monitoring wells and from the Eaton's shallow well are consistent with gasoline contamination. The concentration of contaminants detected in the monitoring well network at Thompson's garage vary significantly. The highest reported concentrations were in MW-3, which is immediately adjacent to the underground storage tanks in a downgradient direction. Reported concentrations of contaminants in MW-4 were lower than in MW-3, and were roughly comparable to those reported in December from the Eaton supply well. The reported concentrations of contaminants in MW-5 were lower than in MW-3 or MW-4. This succeeding increase in contaminant concentrations with decreasing distance to the underground storage tanks indicates that the tanks and their associated plumbing are still a suspected source of contaminants, and that further efforts should be made to conclusively determine whether the tanks or their plumbing are leaking.

It appears that the water quality in the vicinity of the existing and proposed municipal supply wells is not at significant risk from the contaminants in the vicinity of Thompson's garage. The combination of factors involved, including the presence of 2 distinct aquifers separated by a thick clay layer, the relatively large separation between the contaminants and the supply wells, the surficial aquifer flow direction away from the municipal water supply well casings, and the nearly-identical water levels measured in the two aquifers should serve to minimize the possibility of contaminant migration from its present extent into the recharge zone for the supply wells, at least for the amount of time required to remediate the contamination.

Based upon the forgoing discussion, we make the following recommendations:

A. The Eaton residence should be connected to an alternate source of drinking water as soon as is possible. The Woodstock Aquaduct company has indicated a willingness to connect this residence to their supply system. We do not recommend drilling a deep well at the Eaton residence at this time, due to our concerns that contaminants could be introduced into the lower aquifer during installation and perforation of the clay layer, and potentially long-term, due to the potential of leakage around the well casing.

B. The underground storage tanks at Thompson's garage should be further evaluated for leakage as soon as possible. We have been involved in situations where underground storage tanks that have been successfully leak-tested in-place have subsequently been excavated and have been observed to have perforations. We recommend that the tanks be partially uncovered for visual observation, and that appropriate air monitoring equipment be used during the investigation to help pinpoint any leaks. Any leaking tanks or plumbing should be replaced. Only double-walled storage tanks should be used if tanks are in need of replacement. MUST

C. Only a limited additional geological investigation be performed at Thompson's garage, to further define the horizontal and vertical extent of contaminant migration in the shallow aquifer. Specifically, we recommend the installation of a groundwater monitoring well couplet east of the buried tanks to provide additional water level data and to estimate the extent of contaminant migration in a downward direction in the uppermost aquifer. We also recommend that the hydraulic conductivity of the uppermost aquifer be determined via slug tests in the monitoring wells.

D. We recommend that a groundwater remediation system be installed and operated at the garage, to remove contaminants from the groundwater and possibly from the soil in the vicinity of the existing plume. This recommendation is made to further limit the potential for contaminant migration into Broad Brook, and into nearby water supplies.

E. A groundwater sampling and analysis program should be instituted at the garage to monitor the reduction in contaminant levels that would be expected due to the remediation program. The sampling program should occur at a regular frequency, and it should include selected monitoring wells and possibly some of the nearby water supplies as well.

REFERENCES CITED

Stewart, David P., and P. MacClintock, 1969, The Surficial Geology and Pleistocene History of Vermont, Vermont Geological Survey, Department of Water Resources Bulletin #31.

Larson, Frederick D., 1987, Glacial Lake Hitchcock in the Valleys of the White and Ottaquechee Rivers, East Central Vermont, Northeast Intercollegiate Geological Conference Guidebook for field trips in Vermont, Vol. 2.

Fetter, C.W., 1980, Applied Hydrogeology, Charles E. Merrill Publishing Company, Columbus, OH.

Freeze, R. Allan, and John A. Cherry, 1979, Groundwater, Prentice-Hall, Inc., Englewood Cliffs, NJ.

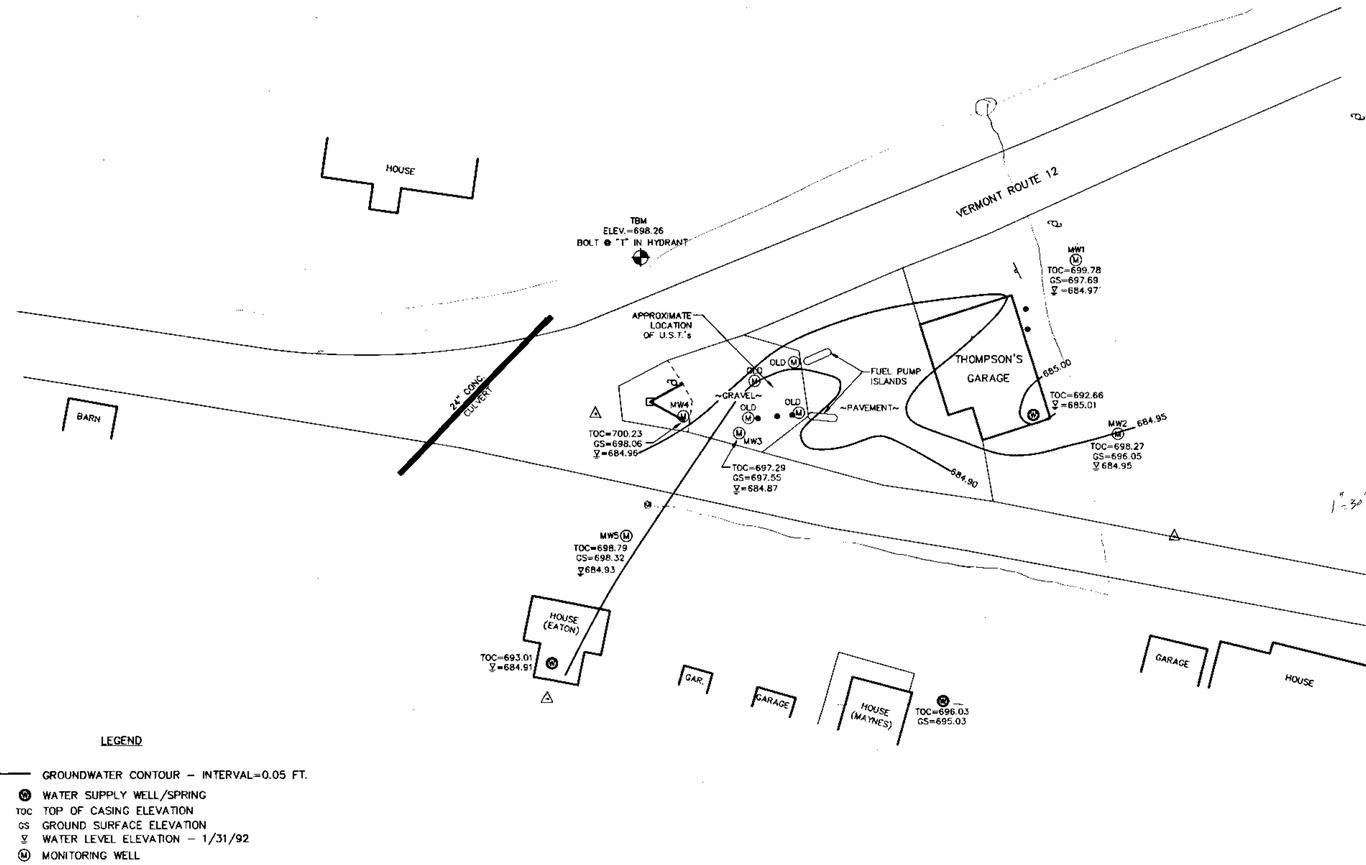
Letter from D.M. Erickson, Registered Geologist, Layne New England, Inc., to Mr. Erle A. Lawton, Webster-Martin Engineers, dated June 11, 1970.

Letter from Kenneth E. Bannister, Hydrogeologist, Wagner, Heindel and Noyes, Inc., to Mr. Eric Wegner, President, Woodstock Aquaduct Company, dated January 7, 1991, with attached undated calculations.

Reviewed by: CTS
I:\PROJECTS\1-2019-1\FINAL.RPT February 13, 1992 12:19 ARL

Attachment 1

Site Plan



LEGEND

- GROUNDWATER CONTOUR – INTERVAL=0.05 FT.
- (M) WATER SUPPLY WELL/SPRING
- TOC TOP OF CASING ELEVATION
- GS GROUND SURFACE ELEVATION
- ▽ WATER LEVEL ELEVATION – 1/31/92
- (M) MONITORING WELL
- ● FILL/VENT PIPES
- BENCHMARK
- △ SURVEY CONTROL POINT
- UTILITY POLE
- TEXACO SIGN
- □ CATCH BASIN
- CULVERT

NOTE: LOCATIONS FROM 1/30/92 SURVEY BY BRUNO ASSOCIATES, INC. OF WOODSTOCK, VERMONT.

Rev. No.	Date	Description	Made by	Chk'd by	App'd by

SITE PLAN
THOMPSON'S GARAGE
WOODSTOCK, VERMONT

FEB 19 1992

Sheet 1 of 1

THE JOHNSON COMPANY, INC.
Environmental Sciences and Engineering
5 STATE STREET
MONTPELIER, VERMONT 05602

Scale: 1"=30'
Drawn by: TJK
Chk'd by: ARL
Date: 2/19/92
Job 1-2019-1

1-2019-1\SITE.dwg

Attachment 2

Soil Boring logs and groundwater monitoring well installation diagrams.

The Johnson Company, Inc.
Environmental Sciences and Engineering
5 State Street
Montpelier, Vermont 05602

DRILLING LOG
WELL # MW1

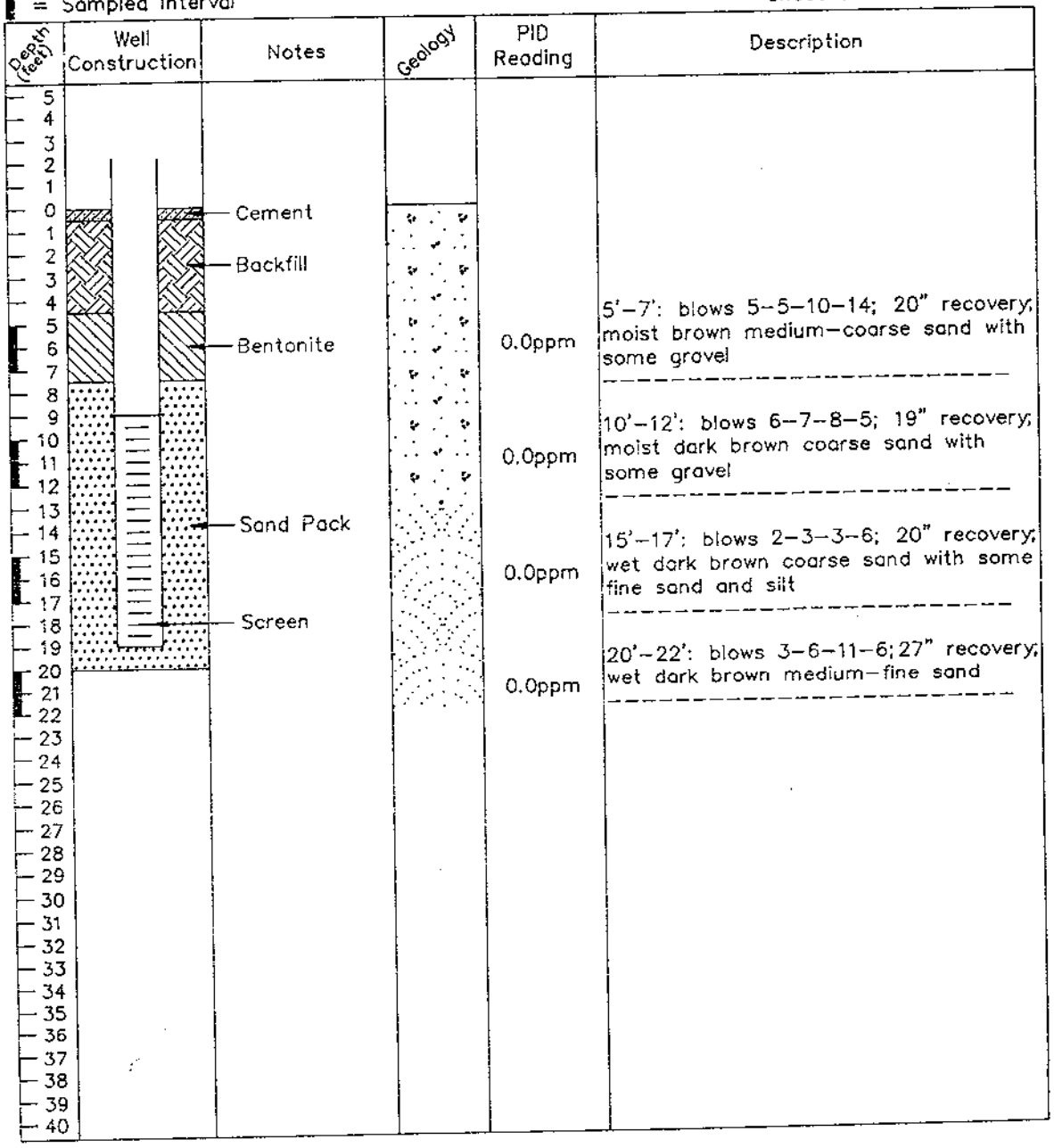
Project: Thompson's Garage
Location: Woodstock, Vermont
Job # 1–2019–1
Logged By: CRH
Date Drilled: 1/7/92
Driller: Tri–State Drilling & Boring
Drill Method: Hollow Stem Auger

Casing Type: PVC
Casing Diameter: 2.0 in.
Casing Length: 11.2 ft.
Screen Type: PVC
Screen Diameter: 2.0 in.
Screen Length: 10.0 ft.
Slot Size: .020

Total Pipe: 21.2 ft.
Stick Up: 2.2 ft.
Total Hole Depth: 20.0 ft.
Well Guard Length: 0.0 ft.
Initial Water Level: –
Surface Elevation: –
T.O.C. Elevation: –

▮ = Sampled Interval

Sheet 1 of 1



The Johnson Company, Inc.
Environmental Sciences and Engineering
5 State Street
Montpelier, Vermont 05602

DRILLING LOG
WELL # MW2

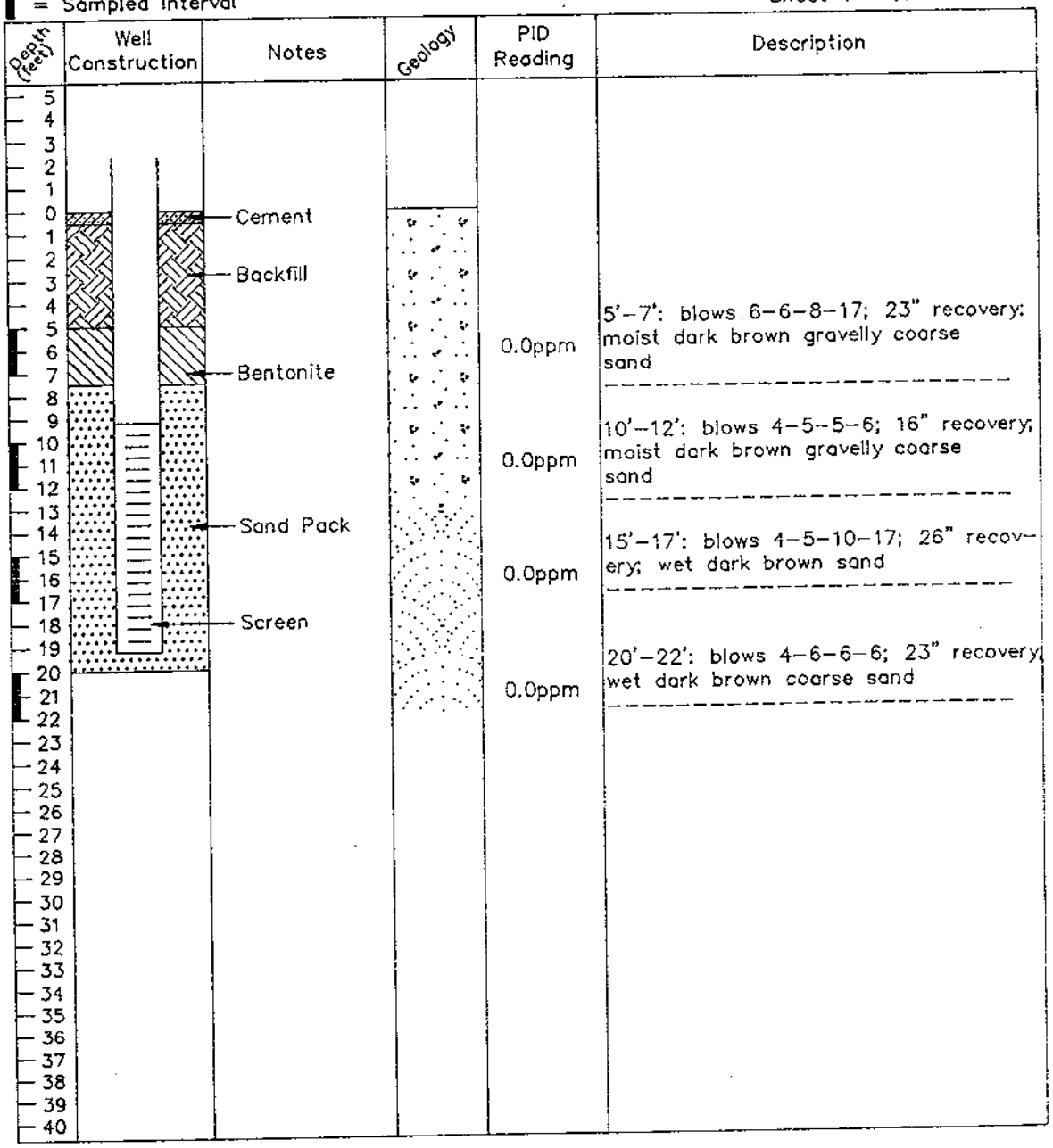
Project: Thompson's Garage
Location: Woodstock, Vermont
Job # 1-2019-1
Logged By: CRH
Date Drilled: 1/7/92
Driller: Tri-State Drilling & Boring
Drill Method: Hollow Stem Auger

Casing Type: PVC
Casing Diameter: 2.0 in.
Casing Length: 11.5 ft.
Screen Type: PVC
Screen Diameter: 2.0 in.
Screen Length: 10.0 ft.
Slot Size: .020

Total Pipe: 21.5 ft.
Stick Up: 2.3 ft.
Total Hole Depth: 20.0 ft.
Well Guard Length: 0.0 ft.
Initial Water Level: —
Surface Elevation: —
T.O.C. Elevation: —

▌ = Sampled Interval

Sheet 1 of 1



The Johnson Company, Inc.
Environmental Sciences and Engineering
5 State Street
Montpelier, Vermont 05602

DRILLING LOG
WELL # MW3

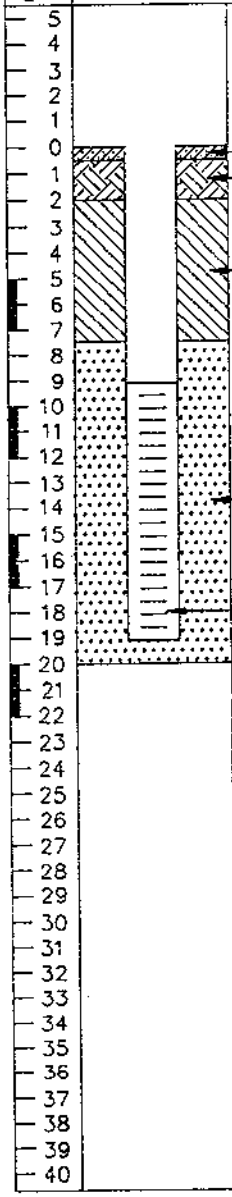
Project: Thompson's Garage
Location: Woodstock, Vermont
Job # 1-2019-1
Logged By: CRH
Date Drilled: 1/7/92
Driller: Tri-State Drilling & Boring
Drill Method: Hollow Stem Auger

Casing Type: PVC
Casing Diameter: 2.0 in.
Casing Length: 8.9 ft.
Screen Type: PVC
Screen Diameter: 2.0 in.
Screen Length: 10.0 ft.
Slot Size: .020

Total Pipe: 18.9 ft.
Stick Up: -0.2 ft.
Total Hole Depth: 20.0 ft.
Well Guard Length: 0.0 ft.
Initial Water Level: --
Surface Elevation: --
T.O.C. Elevation: --

■ = Sampled Interval

Sheet 1 of 1



The Johnson Company, Inc.
Environmental Sciences and Engineering
5 State Street
Montpelier, Vermont 05602

DRILLING LOG
WELL # MW4

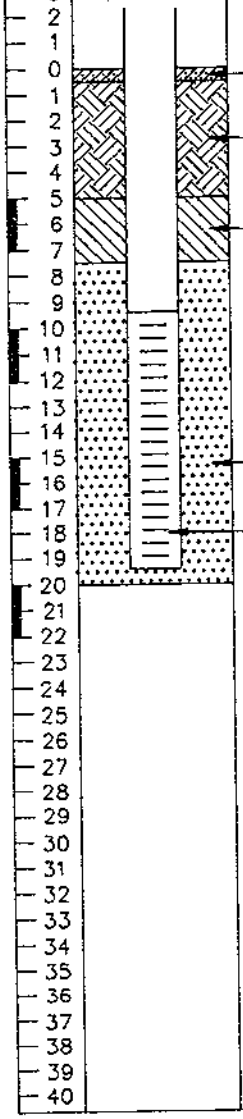
Project: Thompson's Garage
Location: Woodstock, Vermont
Job # 1-2019-1
Logged By: CRH
Date Drilled: 1/7/92
Driller: Tri-State Drilling & Boring
Drill Method: Hollow Stem Auger

Casing Type: PVC
Casing Diameter: 2.0 in.
Casing Length: 11.7 ft.
Screen Type: PVC
Screen Diameter: 2.0 in.
Screen Length: 10.0 ft.
Slot Size: .020

Total Pipe: 21.7 ft.
Stick Up: 2.3 ft.
Total Hole Depth: 20.0 ft.
Well Guard Length: 0.0 ft.
Initial Water Level: –
Surface Elevation: –
T.O.C. Elevation: –

Sheet 1 of 1

▮ = Sampled Interval



The Johnson Company, Inc.
Environmental Sciences and Engineering
5 State Street
Montpelier, Vermont 05602

DRILLING LOG
WELL # MW5

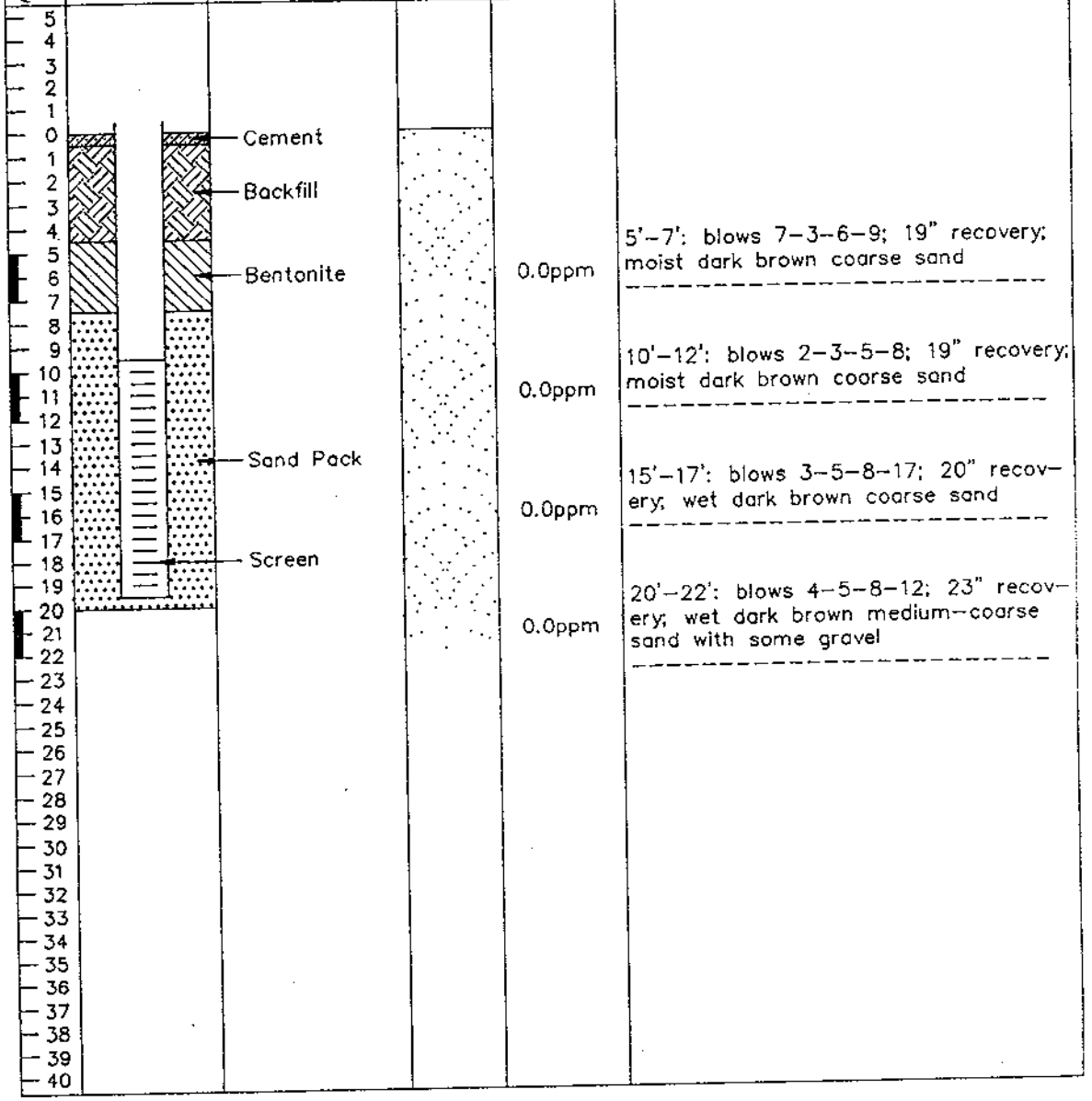
Project: Thompson's Garage
Location: Woodstock, Vermont
Job # 1-2019-1
Logged By: CRH
Date Drilled: 1/7/92
Driller: Tri-State Drilling & Boring
Drill Method: Hollow Stem Auger

Casing Type: PVC
Casing Diameter: 2.0 in.
Casing Length: 10.0 ft.
Screen Type: PVC
Screen Diameter: 2.0 in.
Screen Length: 10.0 ft.
Slot Size: .020

Total Pipe: 20.0 ft.
Stick Up: 0.5 ft.
Total Hole Depth: 20.0 ft.
Well Guard Length: 0.0 ft.
Initial Water Level: –
Surface Elevation: –
T.O.C. Elevation: –

Sheet 1 of 1

■ = Sampled Interval



SOIL PROBE LOG

TRI STATE
DRILLING & BORING, INC.
RFD #2, Box 113 West Burke, VT 05871
(802) 467-3123

		SAMPLER Continuous
TYPE	HSA	
SIZE	4 1/4"	
HAMMER	140#	
FALL	30"	

SOIL
Saturated
Wet
Moist
Damp
Slightly Damp

DATE STARTED:01/06/92 DATE COMPLETED:01/06/92

FOOTAGE DEPTH	BLOW COUNTS 6"	12"	18"	24"	REC	SOIL	DRILLER'S NOTES & COMMENTS
MW#1 .5-7'	4	5	12	17	.20"	Dry	Brown fine to med sand with peastone.
10-12'	6	7	7	6	.19"	Dry	Brown fine to coarse sand.
15-17'	2	3	3	5	.20"	Wet	Brown silty fine sand, some coarse sand and pebbles.
20-22'	3	6	4	6	.24"	Wet	Brown med and coarse sand over 6" of fine silty sand.
							Screen 19' to 9'.
							Sand to 7'6".
							Betonite to 4'6".
							Fill to surface.

Client: Thompson's Garage

Job Location: Woodstock, VT

Engineer: The Johnson Company

Inspector: Carl Hanson

Driller: Neal Faulkner

Helper: Edward Westover

Materials: 10' screen, 10' riser, 2 caps, 3 sand, 1 betonite, 1 well guard.

SOIL PROBE LOG

Page_5_
Monitor Well #2
*Woodstock Vermont

TRI STATE
DRILLING & BORING, INC.
RFD #2, Box 113 West Burke, VT 05871
(802) 467-3123

		SAMPLER Continuous	SOIL
TYPE	HSA		Saturated
SIZE	4 1/4"		Wet
HAMMER	140#		Moist
FALL	30"		Damp
			Slightly Damp

DATE STARTED:01/06/92 DATE COMPLETED:01/06/92

FOOTAGE DEPTH	BLOW COUNTS 6"	12"	18"	24"	REC	SOIL	DRILLER'S NOTES & COMMENTS
MW#2 .5-7'	6	6	8	17	.23"	Dry	Fine to coarse brown sand w/peastone.
10-12'	4	5	5	6	.16"	Wet	Same as above, wet on bottom 6" spoon.
15-17'	4	5	10	17	.26"	Wet	Fine and medium sand.
20-22'	4	6	6	6	.23"	Wet	Med and coarse sand, some fine sand.
							Screen 19' to 9'.
							Sand to 7'6".
							Betonite to 5'.
							Fill to surface.

** Wells no. 2 & 5 Developed with pump. Good flow and clear.
Wells no. 1,3 & 4 Developed by bailing. Good flow but cloudy.

Client: Thompson's Garage

Job Location: Woodstock, VT

Engineer: The Johnson Company

Inspector: Carl Hanson

Driller: Neal Faulkner

Helper: Edward Westover

Materials: 10' screen, 10' riser, 2 caps, 3 sand, 1 betonite, 1 well guard. 12 sample jars.

SOIL PROBE LOG

Page_2_
Monitor Well #3
*Woodstock Vermont

TRI STATE
DRILLING & BORING, INC.
RFD #2, Box 113 West Burke, VT 05871
(802) 467-3123

		SAMPLER Continuous	SOIL
TYPE	HSA		Saturated
SIZE	4 1/4"		Wet
HAMMER	140#		Moist
FALL	30"		Damp
			Slightly Damp

DATE STARTED:01/06/92 DATE COMPLETED:01/06/92

FOOTAGE DEPTH	BLOW COUNTS 6" 12" 18" 24"	REC	SOIL	DRILLER'S NOTES & COMMENTS
MW#3 .5-7'.	.9 .8 .7 .7.	.18"	Dry...	Brown fine to coarse sand.
.....10-12'	.9 .8 .6 .5.	.6"	Dry...	Same as above.
.....15-17'	.5 .5 .4 .5.	.9"	Wet...	Same as above, gas odor.
.....20-22'	.30 .63 .20 .17.	.14"	Wet...	Same as above with peastone.
				Screen 19' to 9'.
				Sand to 7'6".
				Betonite to 2'.

Client: Thompson's Garage

Job Location: Woodstock, VT

Engineer: The Johnson Company

Inspector: Carl Hanson

Driller: Neal Faulkner

Helper: Edward Westover

Materials: 10' screen, 10' riser, 1 cap, 3 sand, 1 locking plug, 2 betonite, 1 road box.

SOIL PROBE LOG

Page_1_
Monitor Well #4
*Woodstock Vermont

TRI STATE
DRILLING & BORING, INC.
RFD #2, Box 113 West Burke, VT 05871
(802) 467-3123

		SAMPLER Continuous
TYPE	HSA	
SIZE	4 1/4"	
HAMMER	140#	
FALL	30"	

SOIL
Saturated
Wet
Moist
Damp
Slightly Damp

DATE STARTED:01/06/92 DATE COMPLETED:01/06/92

FOOTAGE DEPTH	BLOW COUNTS 6"	12"	18"	24"	REC	SOIL	DRILLER'S NOTES & COMMENTS
MW#4 .5-7'.	.8	.8	.6	.8.	.20"	Dry...	Brown fine to coarse sand with some peastone.
.....10-12'	.6	.6	.8	.18.	.18"	Dry...	Same as above with less fine sand and peastone.
.....15-17'	.4	.7	.14	.13.	.19"	Wet...	Fine to coarse brown sand, trace of silt.
.....20-22'	.12	.35	.27	.17.	.19"	Wet...	Same as above with peastone, faint gas odor on augers.

Client: Thompson's Garage

Job Location: Woodstock, VT

Engineer: The Johnson Company

Inspector: Carl Hanson

Driller: Neal Faulkner

Helper: Edward Westover

Materials: 10' screen, 10' riser, 2 caps, 3 sand, 1 betonite, 1 well guard.

SOIL PROBE LOG

Monitor Well #5
*Woodstock Vermont

TRI STATE
DRILLING & BORING, INC.
RFD #2, Box 113 West Burke, VT 05871
(802) 467-3123

		SAMPLER Continuous
TYPE	HSA	
SIZE	4 1/4"	
HAMMER	140#	
FALL	30"	

SOIL
Saturated
Wet
Moist
Damp
Slightly Damp

DATE STARTED:01/06/92 DATE COMPLETED:01/06/92

FOOTAGE DEPTH	BLOW COUNTS 6" 12" 18" 24"	REC	SOIL	DRILLER'S NOTES & COMMENTS
MW#5 .5-7'	2 3 6 9	.19"	Dry...	Brown silty fine sand over 10" of fine to coarse sand.
10-12'	2 3 5 8	.19"	Dry...	Brown fine to coarse sand with peastone
15-17'	3 5 8 17	.20"	Wet...	Brown fine and med sand, some silt.
20-22'	4 5 8 12	.23"	Wet...	Same as above with less silt.
				Screen 19' to 9'.
				Sand to 7'6".
				Betonite to 4'6".
				Fill to surface.

Client: Thompson's Garage

Job Location: Woodstock, VT

Engineer: The Johnson Company

Inspector: Carl Hanson

Driller: Neal Faulkner

Helper: Edward Westover

Materials: 10' screen, 10' riser, 2 caps, 3 sand, 1 betonite, 1 well guard.

Attachment 3

Water quality result data sheets

SCITEST
LABORATORY SERVICES

P.O. Box 339
Randolph, Vermont 05060-0339
(802) 728-6313

LABORATORY REPORT

CLIENT NAME:	The Johnson Company	LABORATORY NO.:	2-0084
ADDRESS:	5 State Street Montpelier, VT 05602	PROJECT NO.:	76611
		DATE OF SAMPLE:	1/16/92
SAMPLE LOCATION:	Thompson's Garage Woodstock, VT	DATE OF RECEIPT:	1/16/92
		DATE OF ANALYSIS:	1/22-23/92
ATTENTION:	Tammy Jacques	DATE OF REPORT:	1/31/92

RESULTS
(ug/l micrograms per liter)

PARAMETER	Trip Blank	MW-1	MW-2	MW-3	MW-4	MW-5
Benzene	BPQL	BPQL	BPQL	3510	46	26
Toluene	BPQL	BPQL	BPQL	10300	614	BPQL
Ethylbenzene	BPQL	BPQL	BPQL	870	12	BPQL
Total Xylenes	BPQL	BPQL	BPQL	9680	4390	BPQL
Chlorobenzene	BPQL	BPQL	BPQL	BPQL	<10	BPQL
1,2-Dichlorobenzene	BPQL	BPQL	BPQL	BPQL	<10	BPQL
1,3-Dichlorobenzene	BPQL	BPQL	BPQL	BPQL	<10	BPQL
1,4-Dichlorobenzene	BPQL	BPQL	BPQL	BPQL	<10	BPQL
Methyl Tertiary Butyl Ether	BPQL	BPQL	BPQL	193	<10	13
% Surrogate Recovery	97%	103%	96%	96% NOTE 1	107% NOTE 1	91% NOTE 1

EPA Method 8020.
BPQL = Below Practical Quantitation Limits. 1 ppb, except as noted.

NOTE 1: Many misc. unknown peaks similar to gasoline.

Respectfully submitted,

SCITEST, INC.

Frederick S. Lamothe
Laboratory Director

RJL/cke

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation
Hazardous Materials Management Division
103 South Main Street, West Building
Waterbury, Vermont 05671-0404
(802) 244-8702

November 26, 1991

Noreen Eaton
Route 12 North
Woodstock, VT 05091

Dear Ms. Eaton:

Enclosed is a copy of the test results for the sample taken from your well on 10/31/91. The results indicate the presence of benzene, toluene, ethylbenzene, and xylene. These are four common compounds found in gasoline. The concentration of benzene in your water at 375 parts per billion exceeds the Department of Health Drinking Water Advisory limit of 5 ppb. As such, your water is considered not safe for drinking.

The treatment system installed by the Vermont Water Treatment Company should remove these contaminants to below detectable limits. However, until laboratory analysis demonstrates that the system is operating effectively, you should not use this water for drinking. Results of samples taken from your system on 11/21/91 should be back within 2 to 3 weeks.

If you have any questions regarding this please call me at 244-8702.

Sincerely,

Bob Haslam

Bob Haslam, Environmental Technician
Sites Management Section

BH:dls1284
Enclosure

DEPT. OF ENVIRONMENTAL CONSERVATION LAB MANAGEMENT SYSTEM PAGE 1

FINAL LAB REPORT

DATE 11/15/91

LAB ID 67253 REPORT TO T/CROPLEY DUE DATE 12/01/91

SOURCE LOCATION 9000HMM032 EATON 1 COLLECTION DATE 10/31/91

PROGRAM 041-UNDERGROUND STORAGE TANK AMBIENT WATER SAMPLE Y

SUBMITTED BY T/CROPLEY PHONE 244-8702 SUBMIT DATE 11/01/91 LEGAL NO

SAMPLE NOTES:

TEST CODE	TEST NAME	RESULT	UNIT OF MEASURE	REMARKS CODE	PROCESS DATE
824W	METHOD 8240 TESTS, WATER	0	NONE	T	11/01/91
VW24	;BENZENE	375	PPB		11/01/91
VW31	;TOLUENE	710	PPB	J	11/01/91
VW38	;ETHYLBENZENE	20	PPB		11/01/91
VW39	;XYLENES	[illegible]	PPB		11/01/91
TVH	* TOTAL VOLATILE HYDROCARBONS	6690	PPB	E	11/01/91

NOV 18 1991

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

824W: T

ple Number: 67253
te Run: 11/01/91
ite: Eaton 1
ate Collected: 10/31/91

Analyst: SRL
Dilution Factor: 5

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	50	ND
VW08	Chloromethane	50	ND
VW09	Bromomethane	50	ND
VW10	Chloroethane	50	ND
VW11	Trichlorofluoromethane	250	ND
VW12	Acetone	10	ND
VW13	1,1-Dichloroethene	10	ND
VW14	Carbon disulfide	10	ND
VW15	Methylene chloride	5	ND
VW16	Methyl-t-butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene	10	ND
VW18	1,1-Dichloroethane	250	ND
VW19	[illegible]	250	ND
VW20	2-Butanone	10	ND
VW21	Chloroform	10	ND
VW22	1,1,1-Trichloroethane	10	ND
VW23	Carbon tetrachloride	10	375
VW24	Benzene	10	ND
VW25	1,2-Dichloroethane	10	ND
VW26	Trichloroethene	10	ND
VW27	1,2-Dichloropropane	10	ND
VW28	Bromodichloromethane	100	ND
VW29	4-Methyl-2-pentanone	10	ND
VW30	cis-1,3-Dichloropropene	10	710 J
VW31	Toluene	10	ND
VW32	trans-1,3-Dichloropropene	10	ND
VW33	1,1,2-Trichloroethane	100	ND
VW34	2-Hexanone	10	ND
VW35	Tetrachloroethene	10	ND
VW36	Dibromochloromethane	10	ND
VW37	Chlorobenzene	10	20
VW38	Ethylbenzene	10	820
VW39	Xylenes	10	ND
VW40	Styrene	10	ND
VW41	Bromoform	10	ND
VW42	1,1,2,2-Tetrachloroethane	500	6690 E
TVH	Total Volatile Hydrocarbons		

Remarks: J because improper dilution for this compound.

Surrogate Recoveries:
1,2-Dichloroethane - D4: 98 % D8-Toluene: 102 % 4-BromoFluorobenzene: 94 %

NOV 22

DEPT. OF ENVIRONMENTAL CONSERVATION LAB MANAGEMENT SYSTEM PAGE 1

FINAL LAB REPORT

DATE 11/15/91

LAB ID 67254 REPORT TO T/CROPLEY DUE DATE 12/01/91

SOURCE LOCATION 9000HMM032 EATON 2 COLLECTION DATE 10/31/91

PROGRAM 041-UNDERGROUND STORAGE TANK AMBIENT WATER SAMPLE Y

SUBMITTED BY T/CROPLEY PHONE 244-8702 SUBMIT DATE 11/01/91 LEGAL NO

SAMPLE NOTES:

TEST CODE	TEST NAME	RESULT	UNIT OF MEASURE	REMARKS CODE	PROCESS DATE
824W	METHOD 8240 TESTS, WATER	0	NONE	T	11/01/91
VW24	;BENZENE	380	PPB		11/01/91
VW31	;TOLUENE	770	PPB	J	11/01/91
VW38	;ETHYLBENZENE	20	PPB		11/01/91
VW39	;XYLENES	875	PPB		11/01/91
TVH	' TOTAL VOLATILE HYDROCARBONS	7280	PPB	E	11/01/91

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67254 Analyst: SRL 624W: T
Date Run: 11/01/91 Dilution Factor: 5
Site: Eaton 2
Date Collected: 10/31/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	50	ND
VW08	Chloromethane	50	ND
VW09	Bromomethane	50	ND
VW10	Chloroethane	50	ND
VW11	Trichlorofluoromethane	50	ND
VW12	Acetone	250	ND
VW13	1,1-Dichloroethene	10	ND
VW14	Carbon disulfide	10	ND
VW15	Methylene chloride	10	ND
VW16	Methyl-t-Butylether (MTBE)	50	ND
VW17	1,2-Dichloroethene	10	ND
VW18	1,1-Dichloroethane	10	ND
VW19	Vinyl acetate	250	ND
VW20	2-Butanone	250	ND
VW21	Chloroform	10	ND
VW22	1,1,1-Trichloroethane	10	ND
VW23	Carbon tetrachloride	10	ND
VW24	Benzene	10	190
VW25	1,2-Dichloroethane	10	ND
VW26	Trichloroethene	10	
VW27	1,2-Dichloropropane	10	ND
VW28	Bromodichloromethane	10	ND
VW29	4-Methyl-2-pentanone	100	ND
VW30	cis-1,3-Dichloropropene	10	
VW31	Toluene	10	
VW32	trans-1,3-Dichloropropene	10	ND
VW33	1,1,2-Trichloroethane	10	ND
VW34	2-Hexanone	100	ND
VW35	Tetrachloroethene	10	ND
VW36	Dibromochloromethane	10	ND
VW37	Chlorobenzene	10	ND
VW38	Ethylbenzene	10	ND
VW39	Xylenes	10	870
VW40	Styrene	10	ND
VW41	Bromoform	10	ND
VW42	1,1,2,2-Tetrachloroethane	10	ND
TVH	Total Volatile Hydrocarbons	500	1,100 E

Remarks: J because improper dilution for this compound.

Surrogate Recoveries:
1,2-Dichloroethane - D4: 96 % D8-Toluene: 108 % 4-BromoFluorobenzene: 94 %

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

AGENCY OF NATURAL RESOU
Department of Environmental Conser
Hazardous Materials Management Divis
103 South Main Street, West Build
Waterbury, Vermont 05671-0
(802) 244-8

December 4, 1991

Jeff Woods
RD 1, Box 104
Woodstock, VT 05091

Dear Mr. Woods:

Enclosed, please find a copy of the analytical results for your water supply from samples collected on 11/6/91. The tests performed were for the most common volatile organic compounds found in gasoline. The tests did not detect any gasoline constituents.

If you have any questions, please feel free to call me.

Sincerely,

Bob Haslam

Bob Haslam, Environmental Technician
Sites Management Section

BH:dls1297
Enclosure

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67331 Analyst: SRL 824W: Z
Date Run: 11/13/91 Dilution Factor: 1
Site: Woods
Date Collected: 11/06/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	10	ND
VW08	Chloromethane	10	ND
VW09	Bromomethane	10	ND
VW10	Chloroethane	10	ND
VW11	Trichlorofluoromethane	10	ND
VW12	Acetone	50	ND
VW13	1,1-Dichloroethene	2	ND
VW14	Carbon disulfide	2	ND
VW15	Methylene chloride	2	ND
VW16	Methyl-t-Butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene	2	ND
VW18	1,1-Dichloroethane	2	ND
VW19	Vinyl acetate	10	ND
VW20	2-Butanone	50	ND
VW21	Chloroform	2	ND
VW22	1,1,1-Trichloroethane	2	ND
VW23	Carbon tetrachloride	2	ND
VW24	Benzene	2	ND
VW25	1,2-Dichloroethane	2	ND
VW26	Trichloroethene	2	ND
VW27	1,2-Dichloropropane	2	ND
VW28	Bromodichloromethane	2	ND
VW29	4-Methyl-2-pentanone	10	ND
VW30	cis-1,3-Dichloropropene	2	ND
VW31	Toluene	2	ND
VW32	trans-1,3-Dichloropropene	2	ND
VW33	1,1,2-Trichloroethane	2	ND
VW34	2-Hexanone	10	ND
VW35	Tetrachloroethene	2	ND
VW36	Dibromochloromethane	2	ND
VW37	Chlorobenzene	2	ND
VW38	Ethylbenzene	2	ND
VW39	Xylenes	2	ND
VW40	Styrene	2	ND
VW41	Bromoform	2	ND
VW42	1,1,2,2-Tetrachloroethane	2	ND
TVH	Total Volatile Hydrocarbon	100	ND

Remarks:

Surrogate Recoveries:
1,2-Dichloroethane - D4: 99 % D8-Toluene: 96 % 4-BromoFluorobenzene: 106 %

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

AGENCY OF NATURAL RESOU
Department of Environmental Conser
Hazardous Materials Management Divis
103 South Main Street, West Build
Waterbury, Vermont 05671-0
(802) 244-8

December 4, 1991

Roger Thompson
Thompson's Garage
RD 1, Box 102
Woodstock, VT 05091

Dear Mr. Thompson:

Enclosed, please find a copy of the analytical results for your water supply from samples collected on 11/6/91. The tests performed were for the most common volatile organic compounds found in gasoline. The tests did not detect any gasoline constituents.

If you have any questions, please feel free to call me.

Sincerely,

Bob Hasler, Environmental Technician
Site Management Section

BH:dls1299
Enclosure

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67330 Analyst: SRL
Date Run: 11/13/91 Dilution Factor: 1
Site: Thompson
Date Collected: 11/06/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	10	ND
VW08	Chloromethane	10	ND
VW09	Bromomethane	10	ND
VW10	Chloroethane	10	ND
VW11	Trichlorofluoromethane	10	ND
VW12	Acetone	50	ND
VW13	1,1-Dichloroethene	2	ND
VW14	Carbon disulfide	2	ND
VW15	Methylene chloride	2	ND
VW16	Methyl-t-Butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene	2	ND
VW18	1,1-Dichloroethane	2	ND
VW19	Vinyl acetate	50	ND
VW20	2-Butanone	50	ND
VW21	Chloroform	2	ND
VW22	1,1,1-Trichloroethane	2	ND
VW23	Carbon tetrachloride	2	ND
VW24	Benzene	2	ND
VW25	1,2-Dichloroethane	2	ND
VW26	Trichloroethene	2	ND
VW27	1,2-Dichloropropane	2	ND
VW28	Bromodichloromethane	2	ND
VW29	4-Methyl-2-pentanone	10	ND
VW30	cis-1,3-Dichloropropene	2	ND
VW31	Toluene	2	ND
VW32	trans-1,3-Dichloropropene	2	ND
VW33	1,1,2-Trichloroethane	2	ND
VW34	2-Hexanone	10	ND
VW35	Tetrachloroethene	2	ND
VW36	Dibromochloromethane	2	ND
VW37	Chlorobenzene	2	ND
VW38	Ethylbenzene	2	ND
VW39	Xylenes	2	ND
VW40	Styrene	2	ND
VW41	Bromoform	2	ND
VW42	1,1,2,2-Tetrachloroethane	2	ND
TVH	Total Volatile Hydrocarbons	100	ND

Remarks:

Surrogate Recoveries:
1,2-Dichloroethane - D4: 96 % D8-Toluene: 96 % 4-BromoFluorobenzene: 102 %

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation
Hazardous Materials Management Division
103 South Main Street, West Building
Waterbury, Vermont 05671-0404
(802) 244-8702

December 4, 1991

Harold Maynes
Border Lane
Woodstock, VT 05091

Dear Mr. Maynes:

Enclosed, please find a copy of the analytical results for your water supply from samples collected on 11/6/91. The tests performed were for the most common volatile organic compounds found in gasoline. The tests did not detect any gasoline constituents.

If you have any questions, please feel free to call me.

Sincerely,

Bob Haslam

Bob Haslam, Environmental Technician
Sites Management Section

BH:dls1298
Enclosure

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67333 Analyst: SPL 824W: Z
Date Run: 11/13/91 Dilution Factor: 1
Site: Maynes
Date Collected: 11/06/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	10	ND
VW08	Chloromethane	[illegible]	ND
VW09	Bromomethane	10	ND
VW10	Chloroethane	10	ND
VW11	Trichlorofluoromethane	10	ND
VW12	Acetone	10	ND
VW13	1,1-Dichloroethene	1	ND
VW14	Carbon disulfide	1	ND
VW15	Methylene chloride	2	ND
VW16	Methyl-t-Butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene	1	ND
VW18	1,1-Dichloroethane	1	ND
VW19	Vinyl acetate	50	ND
VW20	2-Butanone	50	ND
VW21	Chloroform	1	ND
VW22	1,1,1-Trichloroethane	1	ND
VW23	Carbon tetrachloride	1	ND
VW24	Benzene	1	ND
VW25	1,2-Dichloroethane	1	ND
VW26	Trichloroethene	1	ND
VW27	1,2-Dichloropropane	1	ND
VW28	Bromodichloromethane	1	ND
VW29	4-Methyl-2-pentanone	[illegible]	ND
VW30	cis-1,3-Dichloropropene	[illegible]	ND
VW31	Toluene	[illegible]	ND
VW32	trans-1,3-Dichloropropene	1	ND
VW33	1,1,2-Trichloroethane	1	ND
VW34	2-Hexanone	10	ND
VW35	Tetrachloroethene	1	ND
VW36	Dibromochloromethane	1	ND
VW37	Chlorobenzene	1	ND
VW38	Ethylbenzene	1	ND
VW39	Xylenes	1	ND
VW40	Styrene	1	ND
VW41	Bromoform	1	ND
VW42	1,1,2,2-Tetrachloroethane	1	ND
TVH	Total Volatile Hydrocarbons	10	ND

Remarks:

Surrogate Recoveries:
1,2-Dichloroethane - D4: 96 % [illegible]-Toluene: [illegible] % 4-BromoFluorobenzene: 106 %

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation
Hazardous Materials Management Division
103 South Main Street, West Building
Waterbury, Vermont 05671-0404
(802) 244-8702

December 4, 1991

Frank and Rhoda Teagle
Border Lane
Woodstock, VT

Dear Mr. and Mrs. Teagle:

Enclosed, please find a copy of the analytical results for your water supply from sample collected on 11/6/91. The tests performed were for the most common volatile organic compounds found in gasoline. The tests did not detect any gasoline constituents.

If you have any questions, please feel free to call me.

Sincerely,

Bob Haslam

Bob Haslam, Environmental Technician
Site Management Section

BH:dls1296
Enclosure

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67332 Analyst: SRL 824W: Z
Date Run: 11/13/91 Dilution Factor: 1
Site: Teagle
Date Collected: 11/06/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	10	ND
VW08	Chloromethane	10	ND
VW09	Bromomethane	10	ND
VW10	Chloroethane	10	ND
VW11	Trichlorofluoromethane	10	ND
VW12	Acetone	50	ND
VW13	1,1-Dichloroethene	2	ND
VW14	Carbon disulfide	2	ND
VW15	Methylene chloride	2	ND
VW16	Methyl-t-Butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene	2	ND
VW18	1,1-Dichloroethane	2	ND
VW19	Vinyl acetate	50	ND
VW20	2-Butanone	50	ND
VW21	Chloroform	2	ND
VW22	1,1,1-Trichloroethane	2	ND
VW23	Carbon tetrachloride	2	ND
VW24	Benzene	2	ND
VW25	1,2-Dichloroethane	2	ND
VW26	Trichloroethene	2	ND
VW27	1,2-Dichloropropane	2	ND
VW28	Bromodichloromethane	2	ND
VW29	4-Methyl-2-pentanone	50	ND
VW30	cis-1,3-Dichloropropene	2	ND
VW31	Toluene	2	ND
VW32	trans-1,3-Dichloropropene	2	ND
VW33	1,1,2-Trichloroethane	2	ND
VW34	2-Hexanone	50	ND
VW35	Tetrachloroethene	2	ND
VW36	Dibromochloromethane	2	ND
VW37	Chlorobenzene	2	ND
VW38	Ethylbenzene	2	ND
VW39	Xylenes	2	ND
VW40	Styrene	2	ND
VW41	Bromoform	2	ND
VW42	1,1,2,2-Tetrachloroethane	2	ND
TVH	Total Volatile Hydrocarbons	100	ND

Remarks:

Surrogate Recoveries:
1,2-Dichloroethane - D4: 98 % D8-Toluene: 94 % 4-BromoFluorobenzene: 102 %

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67329 Analyst: SRL 824W: Z
Date Run: 11/13/91 Dilution Factor: 1
Site: School
Date Collected: 11/06/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	10	ND
VW08	Chloromethane		ND
VW09	Bromomethane	10	ND
VW10	Chloroethane	10	ND
VW11	Trichlorofluoromethane	10	ND
VW12	Acetone	50	ND
VW13	1,1-Dichloroethene		ND
VW14	Carbon disulfide		ND
VW15	Methylene chloride	2	ND
VW16	Methyl-t-Butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene		ND
VW18	1,1-Dichloroethane		ND
VW19	Vinyl acetate	50	ND
VW20	2-Butanone	50	ND
VW21	Chloroform		ND
VW22	1,1,1-Trichloroethane	2	ND
VW23	Carbon tetrachloride	2	ND
VW24	Benzene		ND
VW25	1,2-Dichloroethane		ND
VW26	Trichloroethene	2	ND
VW27	1,2-Dichloropropane		ND
VW28	Bromodichloromethane	2	ND
VW29	4-Methyl-2-pentanone		ND
VW30	cis-1,3-Dichloropropene		ND
VW31	Toluene		ND
VW32	trans-1,3-Dichloropropene	2	ND
VW33	1,1,2-Trichloroethane	2	ND
VW34	2-Hexanone		ND
VW35	Tetrachloroethene	2	ND
VW36	Dibromochloromethane	2	ND
VW37	Chlorobenzene	2	ND
VW38	Ethylbenzene	2	ND
VW39	Xylenes	2	ND
VW40	Styrene	2	ND
VW41	Bromoform	2	ND
VW42	1,1,2,2-Tetrachloroethane	2	ND
TVH	Total Volatile Hydrocarbons	100	ND

Remarks:

Surrogate Recoveries:
1,2-Dichloroethane - D4: 96 % Toluene-D8: 98 % 4-BromoFluorobenzene: 106 %

DEPARTMENT OF ENVIRONMENTAL CONSERVATION LABORATORY
DATA SHEET METHOD 8240 GC/MS FOR VOLATILE ORGANICS - WATER

Sample Number: 67335 Analyst: SRL 824W: Z
Date Run: 11/13/91 Dilution Factor: 1
Site: T.B.
Date Collected: 11/06/91

		Approximate Detection Limit ug/l	Detected at ug/l
VW07	Vinyl chloride	10	ND
VW08	Chloromethane	10	ND
VW09	Bromomethane	10	ND
VW10	Chloroethane	10	ND
VW11	Trichlorofluoromethane	10	ND
VW12	Acetone	50	ND
VW13	1,1-Dichloroethene	2	ND
VW14	Carbon disulfide	2	ND
VW15	Methylene chloride	2	ND
VW16	Methyl-t-Butylether (MTBE)	10	ND
VW17	1,2-Dichloroethene	2	ND
VW18	1,1-Dichloroethane	2	ND
VW19	Vinyl acetate	50	ND
VW20	2-Butanone	50	ND
VW21	Chloroform	2	ND
VW22	1,1,1-Trichloroethane	2	ND
VW23	Carbon tetrachloride	2	ND
VW24	Benzene	2	ND
VW25	1,2-Dichloroethane	2	ND
VW26	Trichloroethene	2	ND
VW27	1,2-Dichloropropane	2	ND
VW28	Bromodichloromethane	2	ND
VW29	[illegible]	20	ND
VW30	[illegible]	2	ND
VW31	[illegible]	2	ND
VW32	trans-1,3-Dichloropropene	2	ND
VW33	1,1,2-Trichloroethane	2	ND
VW34	2-Hexanone	20	ND
VW35	Tetrachloroethene	2	ND
VW36	Dibromochloromethane	2	ND
VW37	Chlorobenzene	2	ND
VW38	Ethylbenzene	2	ND
VW39	Xylenes	2	ND
VW40	Styrene	2	ND
VW41	Bromoform	2	ND
VW42	1,1,2,2-Tetrachloroethane	2	ND
TVH	Total Volatile Hydrocarbons	100	ND

Remarks:

Surrogate Recoveries:
1,2-Dichloroethane - D4: 99 % D8-Toluene: 98 % 4-BromoFluorobenzene: 103 %

DEPT. OF ENVIRONMENTAL CONSERVATION LAB MANAGEMENT SYSTEM PAGE 1

FINAL LAB REPORT

DATE 12/11/91

LAB ID 67607 REPORT TO M/STADL-MEYER DUE DATE 12/25/91

SOURCE LOCATION 9000911148 EATON IN COLLECTION DATE 11/21/91

PROGRAM 041-UNDERGROUND STORAGE TANK AMBIENT WATER SAMPLE Y

SUBMITTED BY M/STADL-MEYER PHONE 244-8702 SUBMIT DATE 11/25/91 LEGAL NO

SAMPLE NOTES:

TEST CODE	TEST NAME	RESULT	UNIT OF MEASURE	REMARKS CODE	PROCESS DATE
824W	METHOD 8240 TESTS, WATER	C	NONE	I	12/04/91
VW24	;BENZENE	250	PPB		12/04/91
VW31	;TOLUENE	250	PPB		12/04/91
VW39	;XYLENES	420	PPB		12/04/91
TVH	* TOTAL VOLATILE HYDROCARBONS	2850	PPB	E	12/04/91

DEC 1 6 1991

DEPT. OF ENVIRONMENTAL CONSERVATION LAB MANAGEMENT SYSTEM PAGE 1

FINAL LAB REPORT

DATE 12/11/91

LAB ID 67608 REPORT TO M/STADL-MEYER DUE DATE 12/25/91

SOURCE LOCATION 9000911148 EATON MID COLLECTION DATE 11/21/91

PROGRAM 041-UNDERGROUND STORAGE TANK AMBIENT WATER SAMPLE Y

SUBMITTED BY M/STADL-MEYER PHONE 244-8702 SUBMIT DATE 11/25/91 LEGAL NO

SAMPLE NOTES:

TEST CODE	TEST NAME	RESULT	UNIT OF MEASURE	REMARKS CODE	PROCESS DATE
824W	METHOD 8240 TESTS, WATER	0	NONE	Z	12/04/91

FINAL LAB REPORT

DATE 12/11/91

LAB ID 67609 REPORT TO M/STADL-MEYER DUE DATE 12/25/91

SOURCE LOCATION 9000911148 EATON OUT COLLECTION DATE 11/21/91

PROGRAM 041-UNDERGROUND STORAGE TANK AMBIENT WATER SAMPLE Y

SUBMITTED BY M/STADL-MEYER PHONE 244-8702 SUBMIT DATE 11/25/91 LEGAL NO

SAMPLE NOTES:

TEST CODE	TEST NAME	RESULT	UNIT OF MEASURE	REMARKS CODE	PROCESS DATE
824W	METHOD 8240 TESTS, WATER	0	NONE	Z	12/04/91

Attachment 4

Gradient and Velocity Calculations

THE JOHNSON CO., INC.
5 State Street
MONTPELIER, VERMONT 05602
(802) 229-4600

JOB Thompson's Garage 1-2019-1
SHEET NO 1 OF 2
CALCULATED BY ARL DATE 2/6/92
CHECKED BY CTS DATE 2/18/92
SCALE NTS

Calculation of range of hydraulic gradient

Max. Vicinity of MW-3 & MW-4 ⊥ to contour

$$\approx \frac{dh}{dx} = \frac{0.65\ ft}{20\ ft} \cong 0.0325\ ft/ft = 3.25\%$$

Min. Vicinity of MW-1 & MW-3, to 684.5 contour

$$\cong \frac{dh}{dx} \cong \frac{0.63\ ft}{100\ ft} = 0.0063, = 0.6\%\ (1/16)$$

Vicinity of well point — MW2

$$\cong \frac{dh}{dx} \cong \frac{0.10\ ft}{90'} \cong 0.0011, \text{ or about } 0.1\%\ (1/31)$$

Southwest of garage

$$\frac{dh}{dx} \cong 0.000625\ ft/ft = 0.06\%\ (1/31)$$

Southeast of garage

$$\frac{dh}{dx} \cong 0.005 = 0.5\%\ (1/31)$$

Calculate potential Velocity range

Fetter (1980) pg 75

$K \cong 10^{-5}$ cm/sec → 10^{-3} cm/sec for silty sand

$K \cong 10^{-3}$ cm/sec → 10^{-1} cm/sec for well-sorted sands, glacial outwash

Freeze + Cherry (1979) pg 29

$K \cong 10^{-5}$ cm/sec → 10^{-1} cm/sec silty sands

∴ Use range of 10^{-3} cm/sec to *10^{-2} cm/sec for silty fine-coarse sandy gravels

Use $n = 0.25 - 0.35$ (Fetter, 1980, pg 64)
(Freeze + Cherry, 1979, pg 37)

$$K_{max} = 10^{-2}\ \text{cm/sec} \times \frac{2{,}835\ \text{ft/d}}{1\ \text{cm/sec}} = 283.5\ \text{ft/d}$$

$$K_{min} = 10^{-3}\ \text{cm/sec} \times \frac{2{,}835\ \text{ft/d}}{1\ \text{cm/sec}} = 28.35\ \text{ft/d}$$

$$V_{max} = \frac{(283.5\ \text{ft/d})(0.0325\ \text{ft/ft})}{0.25} = 36.9\ \text{ft/d}$$

$$V_{min} = \frac{(28.35\ \text{ft/d})(0.000625\ \text{ft/ft})}{0.35} = 0.05\ \text{ft/d}$$